

ANNEXURE I - Course Curriculum

Stream 1: INTERNET OF THINGS

Unit 1: Fundamentals of IoT

Definition and history of Importance and applications of IoT in various industries of IoT architecture: Devices, Networks, Cloud, Applications

Unit 2: IoT Device Design and Development

Process of designing an IoT device: Requirements analysis, component selection, system integration, and testing Introduction to Arduino UNO: Features, specifications, and programming of Tinkercad: Features, use cases, and circuit design

Unit 3: Advanced IoT Technologies and Protocols

Introduction to ESP32: Features, specifications, and programming Overview of Wokwi: Features, use cases, and circuit design Overview of IoT communication technologies: Wired, wireless, short range, long range Detailed study of specific technologies: Bluetooth, WiFi, Zigbee, LoRaWAN, NBIoT Overview of IoT protocols: HTTP, MQTT, CoAP, AMQP Hands on practical's: Setting up and testing HTTP & MQTT protocols

Unit 4: IoT Integration, Cloud Computing, and Platforms

Introduction to Raspberry PI: Features, specifications, and operating systems Setting up Raspberry PI: Installation, configuration, and basic commands Using Raspberry PI as a gateway in IoT: Role, setup, and use cases Overview of cloud computing: Definition, types, and benefits Introduction to Firebase: Features, use cases, and setup Firebase Cloud & IoT Platform Architecture Hands on practical: Creating and configuring Firebase IoT Platform

Unit 5: Advanced IoT Applications and Smart Systems

Introduction to Node RED: Features, use cases, and setup Node RED programming: Basics, nodes, flows, and debugging Hands on practical's: Web application development using NodeRED Overview of smart home automation: Definition, benefits, and applications Designing a smart home automation system: Components, protocols, and process Overview of computer vision: Definition, importance, and applications Introduction to Python libraries for computer vision: OpenCV, PIL, etc Hands on practicals: Basic computer vision tasks with Python

Course Duration: 45 Hours

Stream 2:DATA ANALYTICS

Unit 1: Introduction to Business Intelligence and IBM Cognos Analytics

Business Intelligence- Key components: data warehousing, data mining, data visualization- Real-world examples and success stories-Overview of IBM Cognos Analytics and its features interface, navigation, and data connections reports, dashboards, and best practices

Unit 2: Data Extraction and Preparation

Concept and role of data extraction-Methods: ETL processes, handling different data sources and formats-Challenges and strategies for large datasets-Practical use cases of Cognos Analytics-Building interactive dashboards and reports storytelling and integrating external data sources

Unit 3: Data Visualization and Exploration

Data visualization principles and techniques the right visualizations -Presenting data effectively to different audiences-Data exploration techniques: summary statistics, data profiling-Visualization libraries: Matplotlib, Seaborn Exploratory data analysis with real-world datasets

Unit 4: Advanced Data Analysis Techniques with Python

Introduction to Python for data analysis of Python programming, data types, control structures-Essential libraries: Pandas, NumPy, data manipulation, and basic ML-Text preprocessing: tokenization, lemmatization, stemming- Part of speech tagging, handling special characters- Implementation using Python

Unit 5: Advanced Techniques in NLP and Exploratory Data Analysis

Identifying and classifying named entities-Techniques: rule-based, machine learning models, pre-trained language model applications, and hands-on projects-Building a complete Data Analyst-Descriptive statistics, distribution analysis outliers and skewness- Advanced NLP techniques and applications-Exploratory data analysis with advanced statistical methods

Course Duration: 45 Hours

Stream 3: Artificial Intelligence

Unit 1: Introduction to Artificial Intelligence and Python Basics

Artificial Intelligence (AI)-Introduction to AI- Types of AI: Narrow AI and General-Realworld applications and societal impact Basics- Introduction to Python- Data types, variables, and basic operations structures: loops and conditional statements-Functions and libraries

Unit 2: Data Wrangling and Neural Networks Fundamentals

Data Wrangling Techniques-Significance in data science-Data cleaning, transformation, and handling missing values-Data aggregation, merging, and reshaping using pandas-Introduction to Neural Networks-Basics of artificial neural networks (ANN)- Layers, activation functions, and backpropagation-Applications and significance

Unit 3: Deep Learning with TensorFlow & Keras

TensorFlow & Keras-Introduction to deep learning frameworks-Building and training basic ANN-Loss functions, optimizers, and overfitting-Convolutional Neural Networks (CNN)- Introduction to CNNs-Building and training CNNs using Keras-Transfer learning and finetuning

Unit 4: Advanced Neural Networks and Natural Language Processing (NLP)

Recurrent Neural Networks (RNN)-Introduction to RNNs-Sequential data processing-Building and training RNN applications: language modeling and sentiment analysis Language Processing (NLP)-Introduction to NLP and its Applications-Text preprocessing techniques NLP models: sentiment analysis and text generation-Overview of NLP libraries: NLTK and spaCy

Unit 5: Cloud-based AI Services and ML Application Deployment

IBM Cloud & Watson AI Services-Introduction to IBM Cloud and Watson AI services-Setting up and using AI services and limitations of cloud-based AI services & Deploy ML Applications end-to-end ML applications deployment techniques: REST APIs and web services practices for scaling and monitoring ML applications- Encouraging students to develop their own ML applications

Course Duration: 45 Hours

Annexure II - Industry Use Cases/Final Projects

Stream 1: INTERNET OF THINGS

Test Projects:

- ✓ Apply acquired knowledge and skills to design and develop a real-world application.
- ✓ Emphasis on Practical Problem-solving
- ✓ Work independently or in teams, demonstrating proficiency in the Artificial Intelligence Project building.

Real-world Problem Statements: Students are required to complete any one problem and design a viable solution

1. Smart Building Management:

Description: IoT sensors and devices are deployed in buildings to monitor and control various systems such as HVAC, lighting, and security, optimizing energy usage and occupant comfort.

1. Sensor Module: Install sensors for monitoring temperature, humidity, occupancy, and air quality.
2. Actuator Module: Implement actuators for controlling HVAC systems, lighting, and security systems.
3. Connectivity Module: Establish a network infrastructure for data transmission and communication between devices.
4. Data Analytics Module: Develop algorithms for analyzing sensor data to optimize energy usage and improve building efficiency.
5. User Interface Module: Create a user-friendly interface for building administrators to monitor and control various systems remotely.

Example: IoT sensors measure occupancy levels and ambient temperature in office buildings, adjusting HVAC settings automatically to maintain optimal comfort levels while minimizing energy waste.

2. Precision Livestock Farming:

Description: IoT sensors and devices are utilized in livestock farming to monitor animal health, behavior, and environmental conditions within barns or pastures, enabling farmers to optimize feeding regimes, detect illness early, and improve overall herd management.

1. Animal Health Monitoring Module: Deploy sensors to monitor vital signs, behavior patterns, and feeding habits of livestock.
2. Environmental Monitoring Module: Install sensors for tracking temperature, humidity, air quality, and other environmental factors in livestock housing.
3. Data Management Module: Develop a centralized database for storing and managing sensor data collected from different areas of the farm.
4. Decision Support Module: Implement machine learning algorithms to analyze data and provide insights for improving livestock health and

productivity.

5. Mobile Application Module: Create a mobile app for farmers to access real-time data and receive notifications about the status of their livestock.

Example: IoT-enabled ear tags equipped with temperature and activity sensors are attached to cattle in a dairy farm. These sensors continuously monitor each cow's body temperature and activity levels. Anomalies such as elevated body temperature or decreased activity can indicate potential health issues, prompting farmers to intervene early with appropriate care and treatment

3. Smart Greenhouse Management:

Description: IoT sensors and actuators are deployed in greenhouses to monitor environmental conditions such as temperature, humidity, light levels, and CO2 levels, and automatically control climate control systems to create optimal growing conditions for plants.

1. Climate Control Module: Install sensors and actuators for regulating temperature, humidity, and CO2 levels inside the greenhouse.
2. Irrigation Management Module: Implement a system for monitoring soil moisture levels and automating the irrigation process based on plant needs.
3. Crop Monitoring Module: Deploy sensors for monitoring plant growth, health, and nutrient levels.
4. Energy Management Module: Integrate renewable energy sources and energy storage systems to optimize energy usage in the greenhouse.
5. Remote Monitoring and Control Module: Develop a platform for remotely monitoring and controlling various greenhouse parameters using a web or mobile interface.

Example: IoT sensors installed throughout a greenhouse measure temperature, humidity, and light intensity in real-time. Based on preset parameters and plant requirements, actuators automatically adjust ventilation, heating, shading, and irrigation systems to maintain ideal growing conditions, maximizing crop yield and quality.

4. Crop Monitoring and Pest Management:

Description: IoT sensors and drones are employed to monitor crop health, growth, and pest infestations in agricultural fields, enabling farmers to make data-driven decisions regarding irrigation, fertilization, and pesticide application

1. Field Surveillance Module: Deploy drones or ground-based sensors equipped with cameras and other sensors for monitoring crop health and detecting pests.
2. Pest Detection and Identification Module: Develop image recognition algorithms to identify pest infestations and differentiate between healthy and damaged crops.
3. Pest Control Module: Implement automated pest control mechanisms such as pesticide spraying drones or targeted traps based on real-time

data analysis.

4. Crop Health Analysis Module: Analyze sensor data to assess crop health, identify nutrient deficiencies, and detect early signs of diseases.
5. Reporting and Alerting Module: Generate reports and send alerts to farmers about potential pest threats or crop health issues.

Example: IoT-enabled drones equipped with multispectral cameras fly over crop fields, capturing images of crop health and identifying areas affected by pests or diseases. Machine learning algorithms analyze the images to detect early signs of stress or infestation, allowing farmers to target specific areas for intervention, such as localized pesticide application or increased monitoring.

5. Aquaculture Monitoring:

Description: IoT sensors are deployed in aquaculture facilities such as fish farms or shrimp ponds to monitor water quality parameters such as temperature, dissolved oxygen, pH, and ammonia levels, ensuring optimal conditions for aquatic organisms

1. Water Quality Monitoring Module: Deploy sensors for monitoring water temperature, pH levels, dissolved oxygen, and other water quality parameters.
2. Fish Behavior Tracking Module: Install underwater cameras and sensors to monitor fish behavior, feeding patterns, and growth rates.
3. Feed Management Module: Implement automated feeding systems that adjust feed quantities based on fish appetite and nutrient requirements.
4. Disease Detection Module: Develop algorithms for early detection of fish diseases based on changes in behavior and physiological parameters.
5. Remote Surveillance and Control Module: Enable remote monitoring and control of aquaculture systems through a centralized dashboard accessible via web or mobile devices.

Example: IoT sensors installed in a fish farm continuously monitor water quality parameters. If the oxygen levels drop below a certain threshold, indicating potential oxygen depletion, the sensors trigger an alarm, prompting farm operators to aerate the water or take other corrective measures to prevent fish mortality. Additionally, data collected over time can be analyzed to optimize feed management and water exchange rates, improving overall fish health and productivity.

6. Predictive Maintenance for Machinery:

Description: IoT sensors are installed on industrial machinery to monitor equipment health parameters such as temperature, vibration, and lubricant condition, enabling predictive maintenance.

1. Sensor Installation Module: Install sensors on machinery to collect data on operating conditions, vibration levels, temperature, and other relevant parameters.
2. Data Acquisition Module: Develop systems for collecting and storing

sensor data in a centralized database or cloud platform.

3. Predictive Analytics Module: Use machine learning algorithms to analyze historical data and predict potential equipment failures before they occur.
4. Maintenance Scheduling Module: Integrate predictive maintenance predictions with maintenance scheduling systems to optimize maintenance activities and minimize downtime.
5. Alerting and Reporting Module: Implement real-time alerting mechanisms to notify maintenance teams of impending equipment failures and generate reports on equipment health and maintenance history.

Example: IoT sensors embedded in manufacturing equipment collect real-time data on machine performance, which is analyzed using predictive analytics algorithms to predict equipment failures before they occur, minimizing downtime and maintenance costs.

7. Remote Equipment Monitoring and Control:

Description: IoT devices are used to remotely monitor and control industrial equipment and processes, enabling remote operation and troubleshooting.

1. Remote Monitoring Module: Equip equipment with sensors for real-time monitoring of performance, condition, and usage patterns.
2. Control Interface Module: Develop a user interface for remotely controlling equipment settings and parameters.
3. Data Transmission Module: Implement a secure data transmission system for sending sensor data from equipment to a centralized server or cloud platform.
4. Fault Diagnosis Module: Utilize machine learning algorithms to analyze sensor data and identify potential faults or anomalies in equipment operation.
5. Predictive Maintenance Module: Integrate predictive maintenance algorithms to anticipate equipment failures and schedule maintenance proactively.

Example: IoT-enabled controllers installed on manufacturing machines allow operators to monitor performance and adjust settings remotely, enabling them to respond to issues quickly without the need for on-site presence.

8. Fleet Management and Telematics:

Description: IoT sensors are installed in vehicles and machinery to track their location, performance, and usage, enabling efficient fleet management and maintenance scheduling.

1. GPS Tracking Module: Equip vehicles with GPS devices for real-time tracking of location, speed, and route history.
2. Vehicle Diagnostics Module: Install onboard diagnostics systems to monitor vehicle performance, fuel consumption, and engine health.
3. Driver Behavior Monitoring Module: Implement sensors and telematics devices to track driver behavior, including speed, braking, and

acceleration patterns.

4. Fuel Management Module: Integrate systems for monitoring fuel levels, consumption rates, and refueling transactions to optimize fuel usage and reduce costs.
5. Fleet Optimization Module: Develop algorithms for route optimization, vehicle allocation, and scheduling to improve efficiency and reduce operating expenses.

Example: IoT devices installed in trucks and construction equipment collect data on vehicle location, engine performance, and fuel consumption, allowing fleet managers to optimize routes, monitor driver behavior, and schedule maintenance proactively.

9. Supply Chain Visibility and Logistics Optimization:

Description: IoT devices are used to track the movement and condition of goods throughout the supply chain, providing real-time visibility and enabling optimization of logistics processes.

1. RFID/Barcode Tracking Module: Implement RFID tags or barcode systems for tracking inventory and assets throughout the supply chain.
2. Real-Time Monitoring Module: Deploy sensors and IoT devices to monitor the status and condition of goods in transit, including temperature-sensitive or perishable items.
3. Route Optimization Module: Utilize GPS data and traffic information to optimize delivery routes, minimize transit times, and reduce fuel consumption.
4. Inventory Management Module: Develop systems for real-time inventory tracking, demand forecasting, and replenishment to prevent stockouts and overstock situations.
5. Collaboration Platform Module: Create a collaborative platform for sharing supply chain data and coordinating activities among different stakeholders, including suppliers, carriers, and retailers.

Example: IoT-enabled tracking devices attached to shipping containers and pallets transmit location and condition data throughout the supply chain, allowing logistics companies to optimize transportation routes, reduce transit times, and ensure product quality and safety.

10. Soil Nutrient Monitoring and Management:

Description: IoT sensors are deployed in agricultural fields to monitor soil nutrient levels, pH, and other soil properties crucial for plant growth. This data is then used to optimize fertilizer application and ensure proper nutrient management, leading to improved crop yields and sustainability.

1. Soil Sensor Deployment Module: Install soil sensors for measuring key nutrient levels such as nitrogen, phosphorus, and potassium.
2. Data Analysis Module: Develop algorithms for analyzing soil nutrient data and generating recommendations for fertilizer application.

3. Fertilizer Application Module: Implement automated fertilizer application systems that adjust application rates based on real-time soil nutrient levels and crop requirements.
4. Crop Response Monitoring Module: Monitor crop growth and health in response to fertilizer applications to assess effectiveness and adjust nutrient management strategies accordingly.
5. Decision Support System Module: Develop a decision support system that integrates soil nutrient data, weather forecasts, and crop information to optimize nutrient management practices and maximize yield.

Example: IoT soil sensors equipped with probes are inserted into the soil at various depths across a farm field. These sensors continuously measure key soil parameters such as nitrogen, phosphorus, and potassium levels, as well as pH and moisture content. The data collected is transmitted wirelessly to a central database or farm management system. Using this real-time information, farmers can precisely tailor fertilizer applications based on the specific nutrient needs of different areas within the field, reducing over-fertilization, minimizing nutrient runoff, and optimizing crop growth while promoting environmental sustainability.

11. Waste Management Optimization

Description: This project aims to optimize waste collection and management processes using IoT technology, reducing costs and environmental impact by improving efficiency and resource allocation.

1. Bin Monitoring Module: Install sensors on waste bins to monitor fill levels and optimize collection routes based on real-time data.
2. Route Optimization Module: Develop algorithms to optimize waste collection routes, minimizing fuel consumption and time spent on collection rounds.
3. Predictive Maintenance Module: Implement predictive maintenance algorithms to identify potential issues with waste collection vehicles and equipment before they occur.
4. Data Analytics Module: Analyze historical data to identify trends and patterns in waste generation, enabling better forecasting and resource allocation.
5. Smart Sorting Module: Integrate sensors and actuators to enable automated sorting of recyclable materials at waste collection points, improving recycling rates.

Example: Smart Trash Bins: IoT-enabled trash bins equipped with fill-level sensors that alert waste management teams when bins are full, optimizing collection schedules.

12. Urban Air Quality Monitoring

Description: This project focuses on monitoring and improving urban air quality using IoT sensors deployed throughout cities, providing real-time data for better

decision-making and public health protection.

1. **Sensor Deployment Module:** Install air quality sensors at strategic locations throughout urban areas to monitor pollutants such as particulate matter, nitrogen dioxide, and ozone.
2. **Data Transmission Module:** Develop a secure and reliable data transmission system to transfer real-time air quality data from sensors to a centralized database or cloud platform.
3. **Visualization Dashboard Module:** Create a user-friendly dashboard for visualizing air quality data in real-time, providing insights to policymakers, city planners, and the public.
4. **Alerting System Module:** Implement an alerting system to notify authorities and the public when air quality levels exceed safe thresholds, enabling timely interventions.
5. **Public Engagement Module:** Develop mobile applications and web portals to engage citizens in air quality monitoring efforts, encouraging behavior change and community involvement.

Examples: Air Quality Sensor Networks: Wireless sensor networks deployed on lampposts, buildings, and other infrastructure to continuously monitor air quality across urban areas.

Stream 2: DATA ANALYTICS

Test Projects:

- ✓ Apply acquired knowledge and skills to design and develop a real-world application.
- ✓ Emphasis on Practical Problem-solving
- ✓ Work independently or in teams, demonstrating proficiency in the Artificial Intelligence Project building.

Real-world Problem Statements: **Students are required to complete any one problem and design a viable solution **

1. Traffic Pattern Analysis:

Description: Data analysts analyze traffic flow data collected from sensors, cameras, and GPS devices to understand traffic patterns, peak hours, and congestion hotspots

Data collection methods: sensors, cameras, GPS devices

1. Identifying peak commuting times
2. Analyzing traffic bottlenecks
3. Optimizing road layouts and traffic signal timings

Example: Data analysts use historical traffic data to identify peak commuting times and traffic bottlenecks, helping urban planners optimize road layouts and traffic signal timings to reduce congestion.

2. Environmental Impact Assessment:

Description: Data analysts assess the environmental impact of infrastructure projects by analyzing data on air quality, water quality, noise levels, and habitat disruption.

1. Analyzing air quality data
2. Assessing water quality data
3. Evaluating noise level data
4. Studying habitat disruption data

Example: Data analysts evaluate environmental data collected from monitoring stations and environmental surveys to assess the potential impact of a new highway construction project on air and water quality, wildlife habitats, and local communities.

3. Cost Estimation and Budget Analysis:

Description: Data analysts analyze project cost data, material prices, labor costs, and construction schedules to estimate project budgets and monitor expenditures.

1. Analyzing project cost data
2. Monitoring material prices
3. Tracking labor costs

4. Comparing project expenses to budget estimates

Example: Data analysts track project expenses and compare them to budget estimates using cost management software, identifying cost overruns or deviations from the budget and advising project managers on cost-saving measures.

4. Building Performance Analysis:

Description: Data analysts analyze building performance data such as energy consumption, indoor air quality, and occupant comfort to optimize building operations and maintenance.

1. Analyzing energy consumption data
2. Studying indoor air quality
3. Assessing occupant comfort
4. Identifying energy saving opportunities

Example: Data analysts analyze energy consumption data from smart meters and HVAC systems to identify opportunities for energy savings, such as upgrading insulation or installing energy-efficient lighting systems in commercial buildings.

5. Infrastructure Asset Management:

Description: Data analysts manage and analyze data on the condition, maintenance history, and lifecycle costs of infrastructure assets to prioritize maintenance activities and asset replacement decisions.

1. Tracking infrastructure condition
2. Analyzing maintenance history
3. Assessing lifecycle costs
4. Developing long-term maintenance plans

Example: Data analysts use asset management software to track the condition of bridges, roads, and water utilities, analyzing data on inspection reports, maintenance records, and asset deterioration models to develop long-term maintenance plans and budget forecasts.

6. Production Yield Analysis:

Description: Data analysts analyze production data to assess production yield, identify factors affecting yield variability, and optimize production processes.

1. Analyzing production logs
2. Studying quality control data
3. Identifying factors affecting yield variability
4. Optimizing manufacturing processes

Example: Data analysts analyze production logs and quality control data to identify correlations between process parameters, equipment settings, and product defects, helping engineers optimize manufacturing processes to improve yield rates.

7. Root Cause Analysis for Equipment Failures:

Description: Data analysts investigate equipment failures by analyzing maintenance records, sensor data, and production logs to identify the root causes of failures and develop preventive maintenance strategies.

1. Analyzing maintenance records
2. Studying sensor data
3. Investigating production logs
4. Developing preventive maintenance strategies

Example: Data analysts analyze equipment failure data to identify recurring failure patterns, such as bearing failures in a particular type of motor, and recommend design improvements or maintenance procedures to reduce the likelihood of future failures.

8. Supply Chain Performance Analysis:

Description: Data analysts assess the performance of supply chain operations by analyzing data on inventory levels, order fulfillment rates, and transportation costs.

1. Analyzing inventory levels
2. Assessing order fulfillment rates
3. Studying transportation costs
4. Identifying bottlenecks in the supply chain

Example: Data analysts analyze supply chain data to identify bottlenecks and inefficiencies in the supply chain, such as excess inventory levels or long lead times, and recommend process improvements to enhance supply chain agility and reduce costs.

9. Customer Behaviour Analysis:

Description: Data analysts analyze customer data such as purchasing behaviour, product preferences, and demographic information to identify trends and patterns and inform marketing and product development strategies.

1. Analyzing purchasing behaviour
2. Studying product preferences
3. Identifying demographic trends
4. Informing marketing and product development strategies

Example: Data analysts analyze customer transaction data to identify cross-selling opportunities and customer segmentation strategies, helping companies tailor marketing campaigns and product offerings to specific customer segments.

10. Energy Usage Optimization:

Description: Data analysts analyze energy consumption data from manufacturing processes to identify opportunities for energy savings and optimize energy usage.

1. Analyzing energy consumption data

2. Studying production schedules
3. Identifying load-shifting opportunities
4. Optimizing energy usage

Example: Data analysts analyze energy usage patterns and production schedules to identify opportunities for load shifting and energy efficiency improvements, such as adjusting production schedules to run equipment during off-peak hours when energy prices are lower.

11. Risk Assessment and Management

Description: Identifying potential risks in projects or operations, analyzing historical data for risk patterns, assessing the impact of risks on project outcomes, and developing risk mitigation strategies.

1. Identifying potential risks in projects or operations
2. Analyzing historical data for risk patterns
3. Assessing the impact of risks on project outcomes
4. Developing risk mitigation strategies

Example: Data analysts use historical project data to identify common risk factors, such as supply chain disruptions or labor shortages. They assess the potential impact of these risks on project timelines and costs. Based on this analysis, they develop risk mitigation strategies, such as contingency plans or alternative suppliers, to minimize the impact of potential risks.

12. Market Trend Analysis

Description: Collecting and analyzing market data, identifying market trends and patterns, studying consumer behavior and preferences, and informing business strategy and decision-making.

1. Collecting and analyzing market data
2. Identifying market trends and patterns
3. Studying consumer behavior and preferences
4. Informing business strategy and decision-making

Example: Data analysts analyze sales data and consumer surveys to identify emerging market trends, such as increasing demand for sustainable products or online shopping preferences. They use this information to guide business strategy, such as developing new product lines or adjusting marketing campaigns to better target consumer preferences

Stream 3: Artificial Intelligence

Test Projects:

- ✓ Apply acquired knowledge and skills to design and develop a real-world application.
- ✓ Emphasis on Practical Problem-solving
- ✓ Work independently or in teams, demonstrating proficiency in the Artificial Intelligence Project building.

Real-world Problem Statements: **Students are required to complete any one problem and design a viable solution **

1. Traffic Flow Optimization:

Description: AI algorithms can analyze traffic patterns, predict congestion, and optimize signal timings to improve traffic flow.

1. Data Collection and Preprocessing
2. Traffic Pattern Analysis
3. AI Model Development for Traffic Prediction
4. Traffic Signal Optimization
5. Performance Evaluation and Optimization

Example: In a city, AI-powered traffic management systems adjust traffic light timings based on real-time traffic data to reduce congestion during peak hours.

2. Structural Health Monitoring:

Description: AI can monitor the health of infrastructure like bridges and buildings by analyzing sensor data to detect signs of damage or deterioration.

1. Sensor Types for Infrastructure Health Monitoring
2. AI Algorithms for Damage Detection in Infrastructure
3. Advantages of Early Detection Using AI
4. Prevention of Catastrophic Failures with AI
5. Real-Time Data Analysis in Structural Health Monitoring

Example: Sensors embedded in a bridge collect data on vibrations, strain, and temperature, which AI algorithms analyze to detect potential structural issues early, preventing catastrophic failures.

3. Urban Planning and Design:

Description: AI assists in urban planning by analyzing data on population growth, land use, and environmental factors to optimize city layouts and infrastructure development.

1. AI Analysis of Population Growth and Land Use Data
2. Key Factors in AI-Optimized City Layouts
3. AI for Identifying Suitable Locations for Development
4. Impact of AI-Driven Urban Planning on Infrastructure
5. AI Contributions to Sustainable Urban Design

Example: AI algorithms analyze demographic trends and land use data to help city planners decide the locations for new residential areas, parks, and transportation networks.

4. Natural Disaster Prediction and Management:

Description: AI models can analyze various data sources like weather patterns, seismic activity, and historical disaster data to predict and mitigate the impact of natural disasters.

1. Data Sources for AI Natural Disaster Prediction
2. AI Analysis of Historical Data for Disaster Prediction
3. Preventive Measures Based on AI Predictions
4. AI Assistance in Disaster Impact Mitigation
5. Benefits of AI-Powered Early Warning Systems

Example: AI-powered systems analyze satellite imagery, weather data, and historical flood records to predict areas at high risk of flooding, enabling authorities to take preventive measures such as reinforcing levees or evacuating residents.

5. Construction Site Safety Monitoring:

Description: AI-powered cameras and sensors can monitor construction sites in real time to detect potential safety hazards and ensure compliance with safety regulations.

1. Technologies for AI-Powered Safety Monitoring
2. Real-Time Hazard Detection by AI Algorithms
3. Role of Computer Vision in Construction Site Safety
4. AI-Driven Safety Monitoring for Compliance
5. Benefits of Proactive Safety Monitoring Using AI

Example: Computer vision systems equipped with AI algorithms analyze video feeds from construction sites to detect workers not wearing proper safety gear or identify hazardous conditions like unstable scaffolding, alerting supervisors to take corrective actions.

6. Predictive Maintenance for Machinery:

Description: AI algorithms analyze sensor data from machines to predict when maintenance is needed, reducing downtime and extending the lifespan of equipment.

1. Types of Sensor Data for AI Predictive Maintenance
2. AI Algorithms for Maintenance Prediction
3. Advantages of Proactive Maintenance Scheduling
4. Reduction of Downtime with AI-Driven Maintenance
5. Impact on Equipment Lifespan with AI Predictive Maintenance

Example: In manufacturing plants, AI monitors machine vibrations, temperature, and other performance metrics to predict when a machine part is

likely to fail, allowing maintenance to be scheduled proactively.

7. Quality Control in Manufacturing:

Description: AI-powered vision systems inspect products on the production line to detect defects and ensure quality standards are met.

1. AI-Powered Inspection on Production Lines
2. Types of Defects Detected by AI in Manufacturing
3. AI-Driven Quality Control for Consistency
4. Benefits of Automated Quality Control in Manufacturing
5. AI's Impact on Product Quality and Customer Satisfaction

Example: Cameras equipped with AI algorithms inspect automotive parts for defects such as cracks or imperfections, ensuring only high-quality parts are used in production.

8. Autonomous Vehicles and Robotics:

Description: AI enables the development of autonomous vehicles and robots that can perform tasks in various industries, from transportation to warehouse logistics.

1. Technologies Enabling Autonomous Vehicles and Robots
2. AI Algorithms for Perception and Decision-Making
3. Challenges and Opportunities in AI for Autonomous Transportation
4. AI-Driven Robotics in Warehouse Logistics
5. Safety Measures in AI-Powered Autonomous Systems

Example: Self-driving cars use AI algorithms to perceive their surroundings, make driving decisions, and navigate safely without human intervention, revolutionizing transportation systems.

9. Energy Efficiency Optimization:

Description: AI algorithms analyze energy consumption data from machines and equipment to optimize energy usage and reduce costs.

1. AI Analysis of Energy Consumption Data
2. Strategies for AI-Optimized Energy Usage
3. Cost Reduction with AI-Driven Energy Efficiency
4. Benefits of Real-Time Energy Monitoring and Adjustments
5. AI's Contribution to Sustainable Energy Practices

10. Supply Chain Management:

Description: AI helps optimize supply chain operations by analyzing data on inventory levels, demand forecasts, and transportation routes to improve efficiency and reduce costs.

1. AI Analysis for Optimizing Inventory Levels
2. AI in Demand Forecasting and Inventory Management
3. Cost Reduction and Efficiency with AI-Driven Supply Chain Management
4. Benefits of Real-Time Data Analysis in Supply Chain Optimization

5. Adapting to Market Trends and Demands with AI

Example: AI algorithms analyze historical sales data and market trends to generate accurate demand forecasts, enabling companies to optimize inventory levels and reduce stockouts while minimizing excess inventory costs.

11. Healthcare Diagnostics and Treatment:

Description: AI plays a pivotal role in revolutionizing healthcare by assisting in diagnostics, treatment planning, and patient care. Through advanced algorithms and machine learning models, AI can analyze medical data, interpret complex images, and provide insights that help healthcare professionals make informed decisions.

1. AI in Medical Image Analysis for Diagnostics
2. Benefits of AI-Powered Diagnostic Systems in Healthcare
3. AI Algorithms for Predicting Patient Outcomes
4. Role of AI in Personalized Treatment Plans
5. AI-Driven Telemedicine for Improved Healthcare Access

Example : AI-powered diagnostic systems can analyze medical images like X-rays, MRIs, and CT scans to detect abnormalities or potential diseases. For instance, AI algorithms can identify early signs of cancer in mammograms, helping radiologists in early diagnosis and treatment planning.

12. Personalized Marketing and Customer Experience:

Description: AI-driven personalized marketing focuses on tailoring marketing strategies and customer experiences based on individual preferences, behaviors, and interests. By analyzing vast amounts of customer data, AI algorithms can predict consumer behavior, segment audiences, and deliver targeted content, thereby enhancing customer engagement and satisfaction.

1. AI in Medical Image Analysis for Diagnostics
2. Benefits of AI-Powered Diagnostic Systems in Healthcare
3. AI Algorithms for Predicting Patient Outcomes
4. Role of AI in Personalized Treatment Plans
5. AI-Driven Telemedicine for Improved Healthcare Access

Example: E-commerce platforms use AI to analyze customer browsing history, purchase patterns, and interactions to recommend personalized product suggestions. For example, online retailers like Amazon utilize AI algorithms to suggest products to customers based on their previous purchases, browsing history, and demographic information, enhancing the overall shopping experience and increasing sales.

Annexure III - Assessment Rubrics

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 100 marks:

COURSE ASSESSMENT RUBRICS (TOTAL MARKS:100)				
ASSESSMENT CRITERIA	DESCRIBE THE CRITERIA OF THE BELOW CATEGORY PERFORMANCE			TOTAL MARKS
	FAIR	GOOD	EXCELLENT	
Problem Definition & Design Thinking	6	8	10	10
Innovation & Problem Solving	10	15	20	20
Implementation of Project	10	15	20	20
Performance of the Project	10	15	20	20
Project Demonstration & Documentation	10	15	20	20
MCQ-based assessment 20 Questions			10	10
Total				100